The National Centre of Science, Information and Communication Technology, and Mathematics Education for Rural and Regional Australia

une
University of New England

Variation in Student Performance on the Mathematical Literacy Scale: PISA 2000

Country	Mean Score	S.E.
Japan	557	(5.5)
Korea	547	(2.8)
New Zealand	537	(3.1)
Finland	536	(2.2)
Canada	533	(1.4)
Australia	**533**	**(3.5)**
United Kingdom	529	(2.5)
Switzerland	529	(4.4)
Belgium	520	(3.9)
France	517	(2.7)
Austria	515	(2.5)
Iceland	514	(2.3)
Denmark	514	(2.4)
Sweden	510	(2.5)
Liechtenstein	514	(7.0)
Ireland	503	(2.7)
OECD average	***500***	***(0.7)***
Norway	499	(2.8)
Czech Republic	498	(2.8)
Germany	490	(2.5)
United States	493	(7.6)
Spain	476	(3.1)
Russian Federation	478	(5.5)
Poland	470	(5.5)
Latvia	463	(4.5)
Italy	457	(2.9)
Portugal	454	(4.1)
Hungary	448	(4.0)
Luxembourg	446	(2.0)
Greece	447	(5.6)
Mexico	387	(3.4)
Brazil	334	(3.7)

une University of New England

Variation in Student Performance on the Mathematical Literacy Scale: PISA 2000

Country	Mean Score	S.E.	
Japan	557	(5.5)	- 557 Capital Centre
Korea	547	(2.8)	
New Zealand	537	(3.1)	
Finland	536	(2.2)	- 535 Capital Elsewhere
Canada	533	(1.4)	
Australia	**533**	**(3.5)**	
United Kingdom	529	(2.5)	
Switzerland	529	(4.4)	- 528 Large Provincial
Belgium	520	(3.9)	- 526 Town
France	517	(2.7)	- 516 Small Town
Austria	515	(2.5)	
Iceland	514	(2.3)	
Denmark	514	(2.4)	- 513 Village
Sweden	510	(2.5)	
Liechtenstein	514	(7.0)	
Ireland	503	(2.7)	
OECD average	***500***	***(0.7)***	
Norway	499	(2.8)	
Czech Republic	498	(2.8)	
Germany	490	(2.5)	
United States	493	(7.6)	
Spain	476	(3.1)	
Russian Federation	478	(5.5)	
Poland	470	(5.5)	
Latvia	463	(4.5)	
Italy	457	(2.9)	
Portugal	454	(4.1)	
Hungary	448	(4.0)	
Luxembourg	446	(2.0)	
Greece	447	(5.6)	
Mexico	387	(3.4)	
Brazil	334	(3.7)	

SiMERR

une University of New England

Mean Performance in 2006 PISA Mathematics

Country	Mean Score	
Chinese Taipei	549	(4.1)
Finland	548	(2.3)
Hong Kong-China	547	(2.7)
Korea	547	(3.8)
Netherlands	531	(2.6)
Switzerland	530	(3.2)
Canada	527	(2.0)
Macao-China	525	(1.3)
Liechtenstein	525	(4.2)
Japan	523	(3.3)
New Zealand	522	(2.4)
Belgium	520	(3.0)
Australia	**520**	**(2.2)**
Estonia	515	(2.7)
Denmark	513	(2.6)
Czech Republic	510	(3.6)
Iceland	506	(1.8)
Austria	505	(3.7)

- 533 Capital Centre

- 530 Large Provincial

- 506 Town

Slovenia	504	(1.0)
Germany	504	(3.9)
Ireland	501	(2.8)
France	496	(3.2)
United Kingdom	495	(2.1)
Poland	495	(2.4)
Slovak Republic	492	(2.8)
Hungary	491	(2.9)
Luxembourg	490	(1.1)
Norway	490	(2.6)
Lithuania	486	(2.9)
Latvia	486	(3.0)
Spain	480	(2.3)
Azerbaijan	476	(2.3)
Russian Federation	476	(3.9)
United States	474	(4.0)
Croatia	467	(2.4)
Portugal	466	(3.1)
Italy	462	(2.3)

- 497 Small Town

- 492 Village

Greece	459	(3.0)
Israel	442	(4.3)
Serbia	435	(3.5)
Uruguay	427	(2.6)
Turkey	424	(4.9)
Thailand	417	(2.3)
Romania	415	(4.2)
Bulgaria	413	(6.1)
Chile	411	(4.6)
Mexico	406	(2.9)
Montenegro	399	(1.4)
Indonesia	391	(5.6)
Jordan	384	(3.3)
Argentina	381	(6.2)
Colombia	370	(3.8)
Brazil	370	(2.9)
Tunisia	365	(4.0)
Qatar	318	(1.0)
Kyrgyzstan	311	(3.4)

SiMERR

une University of New England

Mean Performance in 2006 PISA Science

Country	Mean Score	S.E.
Finland	563	(2.0)
Hong Kong-China	542	(2.5)
Canada	534	(2.0)
Chinese Taipei	532	(3.6)
Estonia	531	(2.5)
Japan	531	(3.4)
New Zealand	530	(2.7)
Australia	**527**	**(2.3)**
Netherlands	525	(2.7)
Liechtenstein	522	(4.1)
Korea	522	(3.4)
Slovenia	519	(1.1)
Germany	516	(3.8)
United Kingdom	515	(2.3)
Czech Republic	513	(3.5)
Switzerland	512	(3.2)
Macao-China	511	(1.1)
Austria	511	(3.9)
Belgium	510	(2.5)

- 536 Capital Centre
- 536 Large Provincial

- 518 Town

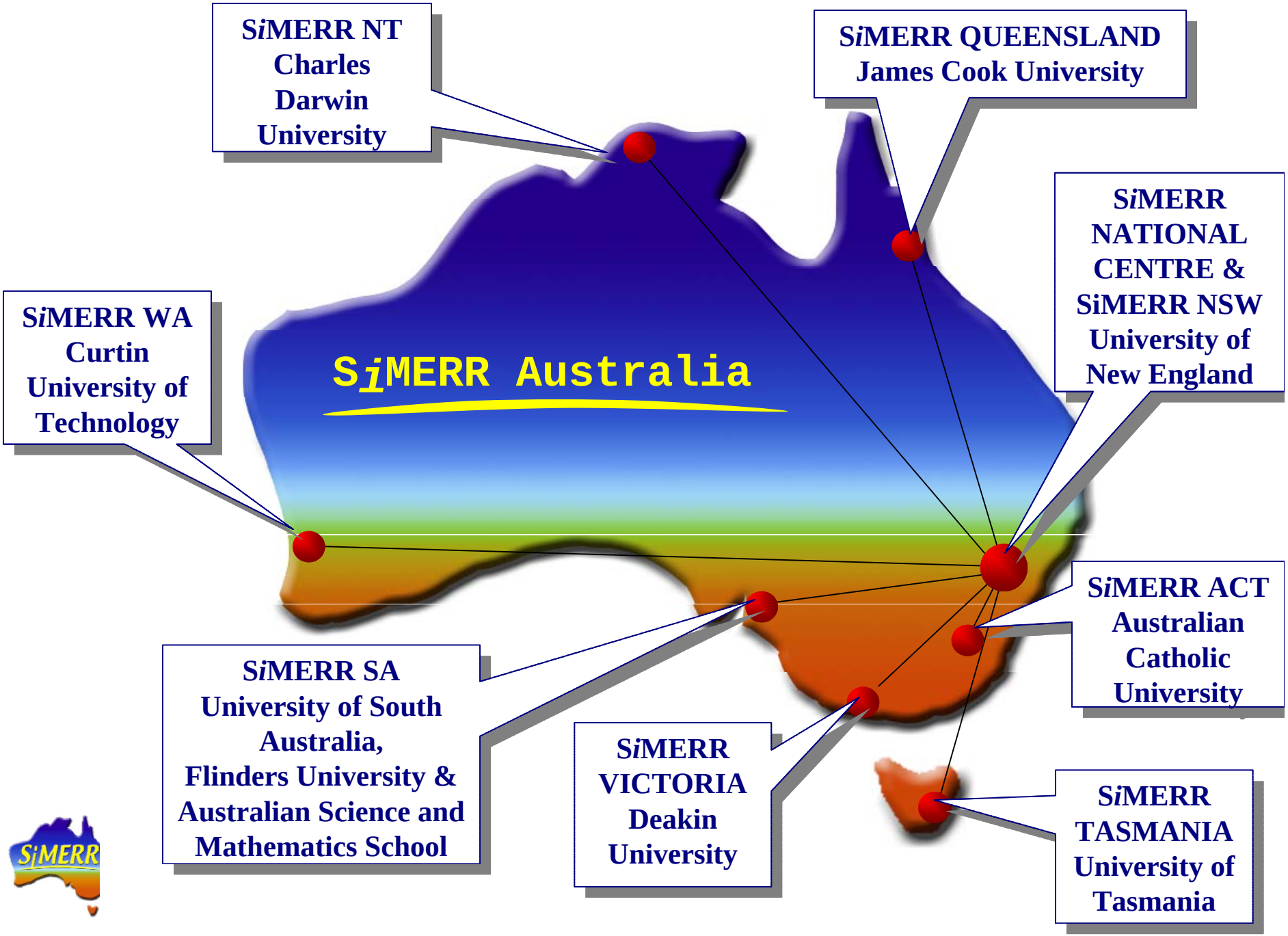
Ireland	508	(3.2)
Hungary	504	(2.7)
Sweden	503	(2.4)
Poland	498	(2.3)
Denmark	496	(3.1)
France	495	(3.4)
Croatia	493	(2.4)
Iceland	491	(1.6)
Latvia	490	(3.0)
United States	489	(4.2)
Slovak Republic	488	(2.6)
Spain	488	(2.6)
Lithuania	488	(2.8)
Norway	487	(3.1)
Luxembourg	486	(1.1)
Russian Federation	479	(3.7)
Italy	475	(2.0)
Portugal	474	(3.0)
Greece	473	(3.2)

- 507 Small Town

- 502 Village

Israel	454	(3.7)
Chile	438	(4.3)
Serbia	436	(3.0)
Bulgaria	434	(6.1)
Uruguay	428	(2.7)
Turkey	424	(3.8)
Jordan	422	(2.8)
Thailand	421	(2.1)
Romania	418	(4.2)
Montenegro	412	(1.1)
Mexico	410	(2.7)
Indonesia	393	(5.7)
Argentina	391	(6.1)
Brazil	390	2.8)
Colombia	388	(3.4)
Tunisia	386	(3.0)
Azerbaijan	382	(2.8)
Qatar	349	(0.9)
Kyrgyzstan	322	(2.9)

une
University of New England


SiMERR NT
Charles Darwin University
SiMERR QUEENSLAND
James Cook University
SiMERR NATIONAL CENTRE &
SiMERR NSW
University of New England
SiMERR WA
Curtin University of Technology
SiMERR Australia
SiMERR ACT
Australian Catholic University
SiMERR SA
University of South Australia,
Flinders University &
Australian Science and Mathematics School
SiMERR VICTORIA
Deakin University
SiMERR TASMANIA
University of Tasmania
SiMERR

SiMERR Vision

SiMERR Australia works with rural and regional communities to achieve improved educational outcomes for all students in the areas of Science, ICT and Mathematics, so that:

- Parents can send their children to rural or regional schools knowing they will experience equal opportunities for a quality education;
- Students can attend rural or regional schools realising their academic potential in Science, ICT and Mathematics; and
- Teachers can work in rural or regional schools and be professionally connected and supported

une
University of New England

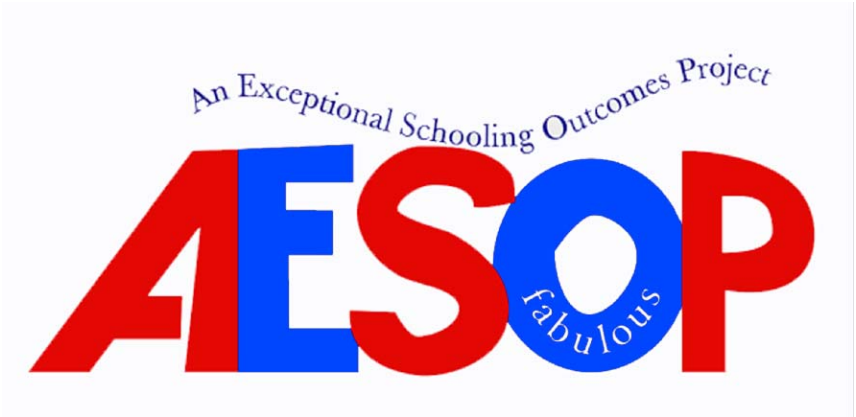
SiMERR is a National Platform to address rural and other important school-education issues.

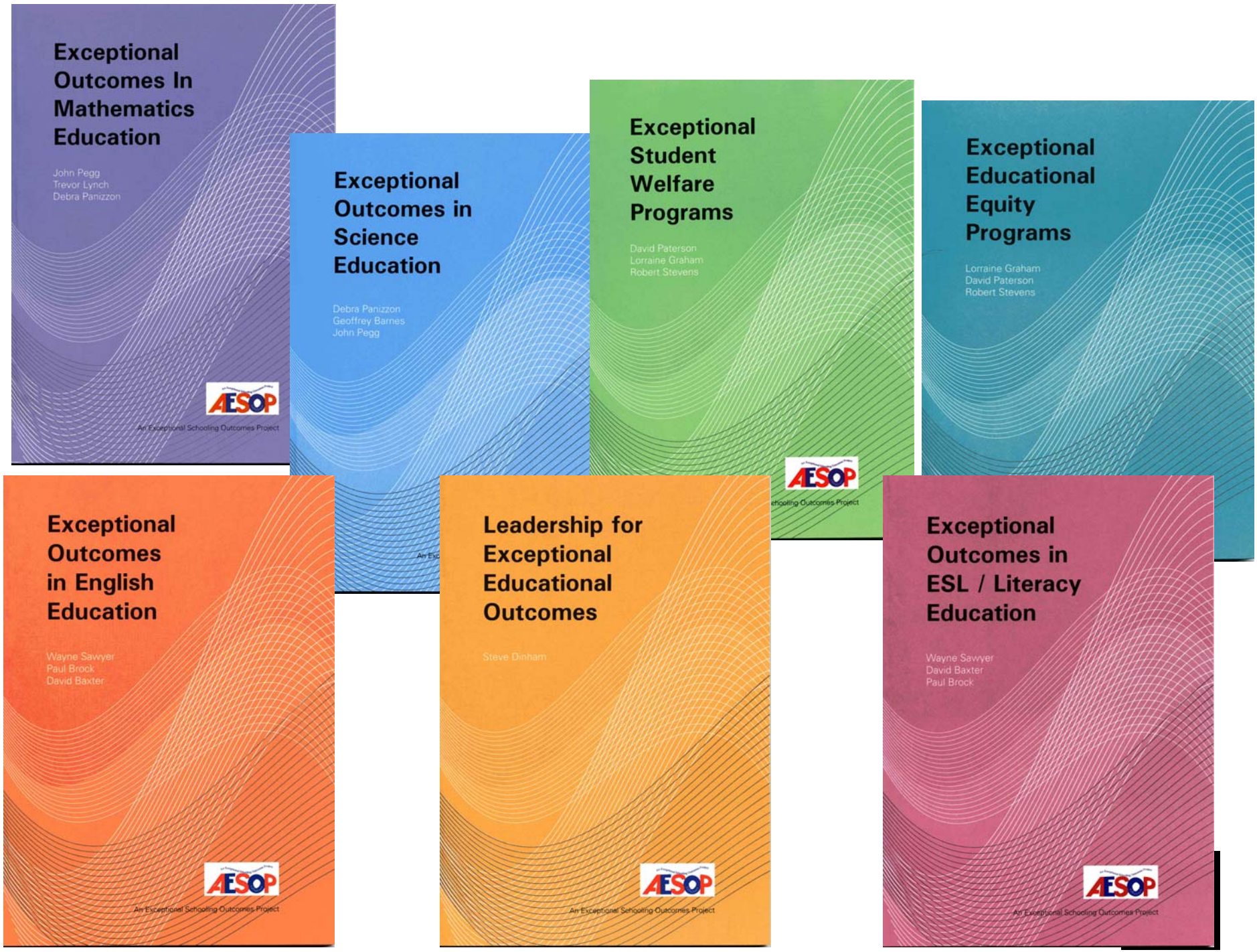
SiMERR targets two specific areas of research and teacher professional learning. SiMERR programs identify and address important educational issues of:

i. specific concern to education in rural and regional Australia, and

i. national concern to education across Australia but ensuring rural and regional voices are represented.

Identifying and analysing processes in NSW public schooling producing outstanding educational outcomes to assist national renewal in junior secondary school education




Exceptional Outcomes In Mathematics Education
John Pegg
Trevor Lynch
Debra Panizzon
AESOP
An Exceptional Schooling Outcomes Project
Exceptional Outcomes in Science Education
Debra Panizzon
Geoffrey Barnes
John Pegg
Exceptional Student Welfare Programs
David Paterson
Lorraine Graham
Robert Stevens
Exceptional Educational Equity Programs
Lorraine Graham
David Paterson
Robert Stevens
Exceptional Outcomes in English Education
Wayne Sawyer
Paul Brock
David Baxter
Leadership for Exceptional Educational Outcomes
Steve Dinham
Exceptional Outcomes in ESL / Literacy Education
Wayne Sawyer
David Baxter
Paul Brock

A Project to Validate Draft National Professional Teaching Standards for Every State and Territory in Australia

for the Australian Institute for Teaching and School Leadership

aitsl AUSTRALIAN INSTITUTE FOR TEACHING AND SCHOOL LEADERSHIP LIMITED

SiMERR

une University of New England

Focus on two different studies

ITAM **I**mproving **T**eaching **A**pproaches to **M**athematics

The philosophy of ITAM is one of facilitators assisting professionals in awareness raising and in identifying issues for themselves which relate to the unique situation and context of their own school.

QuickSmart

A second-chance program for students aged 10 to 14 years who are at or below National Benchmarks in school Mathematics, i.e., the bottom 30% of the achievement spectrum. From 2 schools in 2001 now adopted by over 5% of Australian schools.

SiMERR

une University of New England

Some Background Ideas I Carry Into Professional Learning Projects

These have to do with:

What is meant by success?
Broad teacher characteristics?
What about the brain and learning
– Neuroscience perspective (Neural pathways)
– Cognition perspective (Information processing)?
General ideas about change/growth
Participants' roles (teachers and facilitators)
– leading formative and summative evaluations

une
University of New England

The focus of these two projects is on the provision of professional learning in two different ways. These programs may be considered at two ends of a spectrum: School leading and Tertiary Institution leading.

There is teacher learning and facilitator learning in both.

What counts as success for both partners?

- Against what criteria can success by judged?
- Is enjoying ourselves
  or working hard
  or having a full program, enough?
- Is our personal growth enough?

une
University of New England

Criterion applied for both programs is:

"Any in-service activity which does not improve, modify or update actual practice at the point of delivery has not been successful. The only criterion against which efficacy of in-service provision can be judged is one of improving classroom practice ....."

Mike King, 1988. Open University Press

Significantly this means

(a) In the classroom, i.e., child related practice.

(b) In the nature of courses offered, i.e., improving curriculum interpretation, materials and delivery.

une
University of New England

A teacher perspective

Doyle and Ponder (1977) provide three images of the teacher that they found in the innovation and change literature:

1. the rational adopter;
2. the stone-age obstructionist; and
3. the pragmatic sceptic.

Doyle and Ponder have argued that although most of the literature assumed that teachers are rational adopters, in fact most teachers are pragmatic sceptics.

According to Doyle and Ponder (1977) in reacting to change proposals pragmatic sceptics are swayed by the “practicality ethic”.

This means taking into account :

1. whether it works, or whether it is congruent with their existing perceptions and practice, and

2. its cost in time, energy, stress and disruption versus any personal satisfaction or public recognition to be gained from the change.

A Neuroscience Perspective

Consider the difficulty in bringing about sustained change in teaching practice:

Let us reflect on neural pathways:

1. for humans in general, and

2. for teachers in particular as in presenting lessons and also about change in practice

une
University of New England

In terms of the work of Professor John Hattie (personal communication) an average effect size for a cohort over a year is expected to be about 0.3. He states that effect sizes in the range

0 – 0.2 are not worth pursuing unless some cumulative effect can be considered

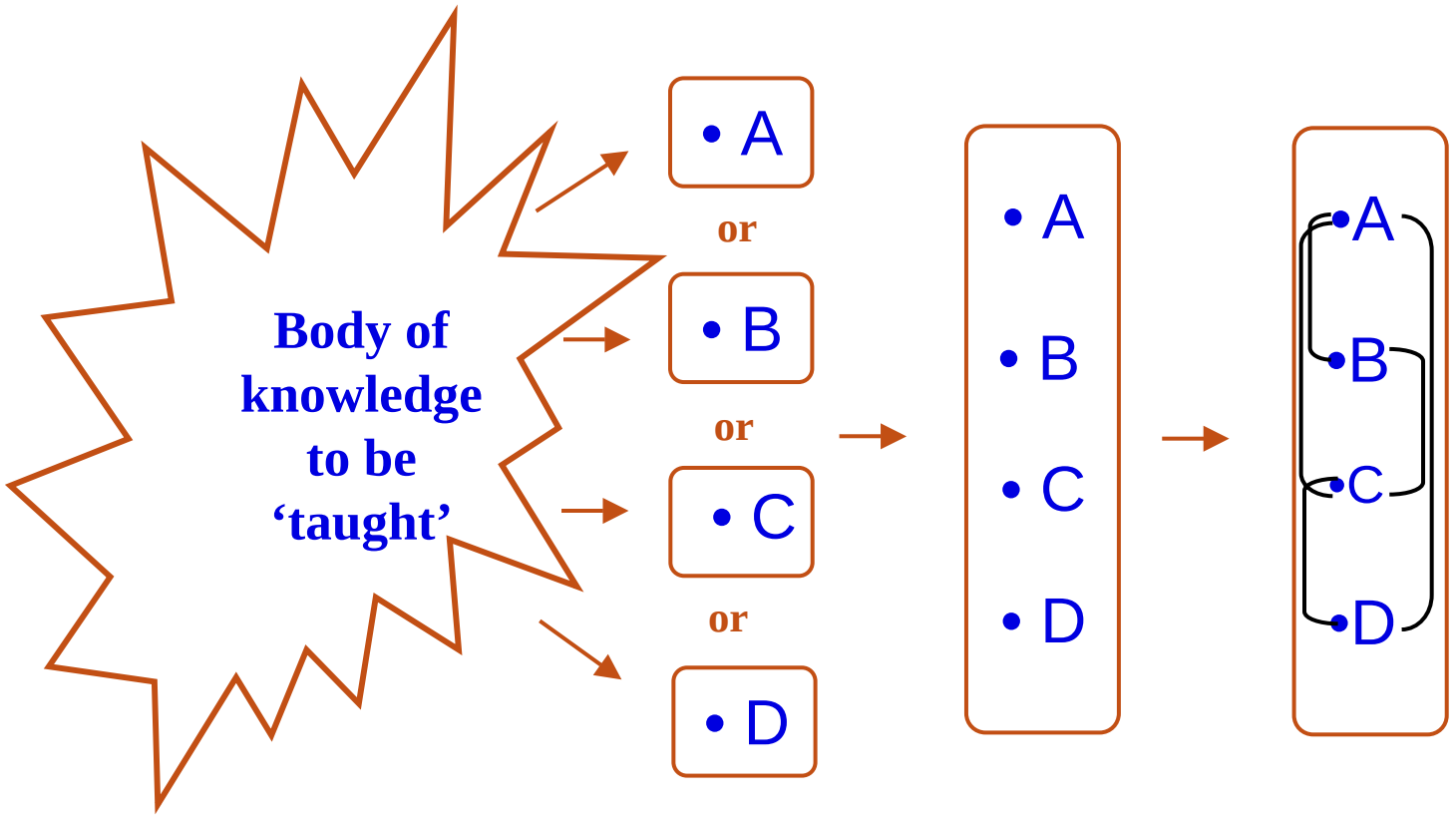
0.2 – 0.4 are interesting and worth pursuing

0.4 – 0.6 something important is happening

0.6 – 0.8 this is showing some major/ significant improvements

0.8 – 1.00 too much to expect and probably there are other intervening factors responsible for the grow

A Cognition Perspective



A Fundamental Learning Cycle (Pegg &Tall in Sriraman & English: *Theories of Mathematics Education : Seeking New Frontiers*)

Unistructural responses A or B or C or D

Multistructural responses A and B and C and D (or a subset)

Relational responses A B C D or A C B D or B D A C or..

- This three-level cycle reoccurs over and over again.
- The key point is that it takes the brain considerable time to achieve a relational response in any particular cycle.

une
University of New England

How are these levels determined for a particular task?

1. General cognitive abilities
2. Familiarity of the content
3. Presentation of the task
4. Degree of interest or motivation
5. Amount of relevant information that can be retained simultaneously for this task
6. Amount of information processing required for solution

5&6 Lead to the notion of *Working Memory* (WM)

Working Memory (WM)

WM is usually defined as the ability to hold information in the mind while transforming it, or other information.

WM is used to organise, contrast, compare, or work on information.

WM is limited in capacity and duration. As we become more expert in a task, our WM does not increase but becomes more efficient.

A person can only process 2 or 3 items of information simultaneously as apposed to merely holding about 7 bits of information at a time.

Implications for learning 1

- Human intelligence comes from stored knowledge, not long chains of reasoning in WM
- Skilled performance consists of building increasing numbers of increasingly complex schemas by combining elements consisting of low level schemas into high level schemas
- A schema can hold a huge amount of information as a simple unit in working memory
- Higher-order processing occurs when there is ‘sufficient space’ in working memory so that appropriate schemas can be accessed from long-term memory and worked upon.

une
University of New England

Professional Learning is a Partnership

Learning **is** taking place for all parties involved

However, the form of learning is usually different

une
University of New England

Important - two issues are taking place for both the Teacher and the Professional Learning facilitators

The innovation itself

This should :
(I) be formative and ongoing

(ii) occur at regular intervals or critical points; and

(iii) inform ongoing future action.

The processes of change

These should:
(i) be summative;

(ii) occur at the end of the process; and,

(iii) consider how effective participants have been as a "change agent".
e.g., How have I done? How could I do it more effectively? What have I learnt?

[Collect data throughout the process but analyse it at the end.]

Important not confuse the two.
They serve different purposes.

SiMERR

une University of New England

ABOUT CHANGE

- Training has been replaced by development/learning.
  - more than semantics, implies a move away from filling up deficiencies towards lifelong learning.

- Change is seen as a process rather than an event.

- Need to consider the complexity of the change process e.g., it is long-term - not a single event

- The process has a strong social character but can be considered to be a very personal experience.

- Change can also be superficial
  - look good, hence, the importance of evidence

ABOUT CHANGE

- Change may mean different things to teachers at different career points.

- We need to look more closely not at the provision of teacher growth but the process of teacher growth.

- Direction of Change
  - External: top-down, covering deficiencies, bringing in new ideas
  - Internal: bottom-up (collaborative), builds on strengths

  Need to be careful – External, top-down, can be a positive experience.

OTHER POINTS TO CONSIDER

- By starting a process it implies some change will occur.
- All change can be threatening.
- Need for change implies things are not working as well as they could.
- Need for great care and sensitivity in the way the change process is addressed.
- Needs to be an appropriate climate to bring about change.

About ITAM

ITAM builds upon, and extends, the skills and knowledge base of participants by addressing and solving an important practical problem identified by the staff and addressed over an extended period of time.

The facilitators' role is one of acting as catalysts for innovative actions and providing the necessary knowledge about, and impetus for, change.

Importantly, the model gives the staff ownership of the issue being investigated, the solution, and the type of support required.

une
University of New England

PARTICIPATION IN A DECISION MAKING PROCESS CARRIES WITH IT A COMMITMENT TO THE DECISION

Involvement

Participation

Joint Ownership

Commitment to a Solution.

quicksmart

Fast and Accurate Basic Skills

Assisting students to undertake higher-order mental processing by improving their information retrieval times

SiMERR

une University of New England

quicksmart Implementation

- We work with school learning communities of 10 to 15 schools; 3 lots of 2 days in Year 1, 3 lots of 1 day in Year 2 and 2 days in Year 3
- Principals attend a one-day professional learning session each year. They can bring senior staff as well.
- The Principal or senior executive chair a School *QS* committee
- The school *QS* instruction team consists of a teacher coordinator and instructors who maybe teacher assistants (para-professionals)

SiMERR

une University of New England

quicksmart Implementation 2

- Students are involved in pairs in three 30-minute lessons a week
- Students are tested prior to intervention and at the end of the 30 week program on independent tests
- National testing data used to judge growth over time
- Comparison students are used to interpret growth in an individual school
- Teachers present progress reports to learning community of schools at the second and third workshops
- Qualitative data collected at end of project from students, parents, staff, etc

SiMERR

une University of New England

What structures produce best *QS* results

1. Embedding instruction in a supportive and well organised learning structure within a school
2. The ‘right’ classroom instruction addressing the students real level
3. Having a community of schools experiencing both similar and different successes and sharing these
4. Having senior management understand and commit to the program and acknowledge the successes
5. Having endorsement and support from a State/Territory-wide perspective

It is the full ***Nested Learning System* for a thinking curriculum** proposed by Lauren Resnick (2009)

Overall achievements

Substantive evidence exists that:

In 30 weeks *QS* students grow 2-4 years compared to growth of average-achievers on independent, standardised or national/state tests and up to a factor of 8 on their previous growth

QS students maintain and extend gains on these tests 2, 3 and 5 years after the intervention

QS is successful with Indigenous and non-Indigenous students

QS is transformational for students in their education by improving student attendance rates, and attitudes to class and learning.

une
University of
New England

What **Positive** Features Practising Teachers Report About Inservice (1)

- Working with practising teachers
- Collegiality
- Getting to know more teachers
- Sharing ideas and strategies
- Keeping in touch with new ideas
- Innovative ideas

une
University of New England

What **Positive** Features Practising Teachers Report About Inservice (2)

- Learning about research
- Testing research findings
- Finding out about resources
- Getting a product that is useable
- Handouts for easy use

What Positive Features Practising Teachers Report About Inservice (3)

- Taking 'goodies' home with you
- Chance to experiment with new ideas
- Can spark new enthusiasm
- Increase in feeling of competence
- Participants have a clearly defined role

une
University of New England

What Positive Features Practising Teachers Report About Inservice (4)

- Participants having a say
- A high level of activity
- Time out from school
- Break from routine